

REMARKS

Claims 1-20 are currently pending. Claims 6 and 9 have been amended. New claims 12-20 have been added. Reconsideration is respectfully requested.

Restriction Requirement

As noted at page 1 of the Office Action, the Office has imposed a restriction requirement requiring election of claims 1-5 (Group I) directed to a multi-foil optic or election of claims 6-11 (Group II) directed to a method and apparatus for high energy lithography. Applicants affirm the provisional election with traverse of claims 1-5 made via telephone on June 7, 2004. In addition, independent claims 6 and 9 have been amended herein to recite the multi-foil optic configuration of claim 1. Accordingly, it is believed that examination of claims 6-11 would place no undue burden on the Examiner, and examination on the merits of claims 6-11 is respectfully requested. The amendments are not being made with regard to patentability; rather, the amendments are being made to gain examination of claims 6-11.

Drawing Objection

The Office Action includes an objection to the drawings and suggests that Figure 1 should be labeled "Prior Art" in view of Figure 1 of the article "Instrumentation for a Next Generation All-Sky Monitor" by A.G. Peele ("the Peele article"). The objection is respectfully traversed. The thickness of the individual glass reflectors of the Peele Figure 1 device is disclosed as 140 microns (see page 6 of the Peele article). However, Figure 1 of the present application does not indicate a plate thickness of 140 microns. Also, independent claims 1, 6 and 9 of the present

application recite that each plate has a thickness in the range of 50-70 microns. Thus, there is no need to label Figure 1 as "prior art". Withdrawal of the objection is respectfully requested.

Art Rejections

The Office Action includes a rejection of claims 1-3 under 35 U.S.C. § 103(a) as allegedly being unpatentable over the Sarfati article ("Lobster eyes - brilliant geometric design") in view of the Petre article ("Physics of X-ray Imaging") and in view of the Zola patent (U.S. Patent No. 4,856,043). This rejection is respectfully traversed.

Claim 1 recites a multi-foil optic comprising a plurality of flat plates each having a reflecting surface. The flat plates are positioned normal to an arc to provide total external reflection to high energy radiation incident on the plates from a high energy radiation source and to focus the incident high energy radiation on a designated surface. Each plate has a thickness in the range of 50-70 microns.

Claim 6 recites a method for performing high energy radiation lithography using such a multi-foil optic, and claim 9 recites a high energy lithographic system comprising such a multi-foil optic. The subject matter recited in independent claims 1, 6 and 9 is not obvious in view of the above-noted references at least for reasons set forth below.

Applicants respectfully submit that the Office's rejection does not make out a *prima facie* case of obviousness. First, Applicants respectfully submit that one of ordinary skill in the art would not have been motivated to modify the Sarfati device as suggested by the Office. The Sarfati article discloses a lobster-eye device for use in

connection with an x-ray telescope. As noted at page 2 of the Sarfati article, the device comprises a 5 cm by 5 cm array of tiny square hollow tubes (10-200 microns across) made of X-ray-reflecting lead glass, about 0.5-1.0 mm deep, which is heated and curved into part of a sphere, like a lobster eye. A hundred such devices are grouped into modules, and 20 such modules are fitted to a telescope. The device focuses x-ray radiation by reflecting x-ray radiation from sides of the hollow tubes made of X-ray reflecting lead glass, such as shown in the figure on page 1 of the Sarfati article. In other words, the lobster-eye device disclosed in the Sarfati article is a focusing device.

The Office suggest that it would have been obvious to modify the plates of the Sarfati device to have thickness of 50-200 microns in thickness as disclosed in the Zola patent for the purpose of allegedly providing finer collimation of an X-ray beam. Applicants respectfully disagree.

In contrast to the focusing device disclosed in the Sarfati article, the device disclosed in the Zola patent is a collimating Soller slit comprising a plurality of grooves in two identical ceramic blocks wherein the blocks are bound together and wherein parallel blades of each block facing each other (see, e.g., Abstract). Contrary to the Office's suggestion, there is no disclosure in the Zola patent of using the Soller slit disclosed therein to focus X-rays. The device is clearly collimating device that produces a highly parallel beam of X-rays passing therethrough, and the "fine collimation" referred to in the Zola patent clearly refers to the highly parallel nature of the radiation (see, e.g., col. 1, lines 5-37). Moreover, in contrast to the Sarfati device, which is a reflection device, the Zola device is an absorption device that absorbs non-parallel X-rays to produce highly parallel X-ray radiation (see, e.g.,

col. 1, lines 36-36, and col. 3, lines 36-38). As such, one of ordinary skill in the art would not look to the Zola patent, which discloses a collimation device that works by absorption, for insights into optimizing a lobster-eye device as disclosed in the Sarfati article, which is a focusing device that works by reflection. Withdrawal of the rejection is respectfully requested for at least this reason.

The Office relies on the Petre article for allegedly disclosing the use of total external reflection in X-ray imaging. The Petre article does not disclose a plurality of flat plates with the configuration recited in claim 1, nor the thickness range recited in claim 1. Accordingly, the Office's reliance on the Petre article does not make up for the deficiencies of the Sarfati article as discussed above.

In addition, even if the disclosures of the applied references were hypothetically combined as suggested by the Office, the resulting hypothetical combination would still not possess the features recited in independent claims 1, 6 and 9. For example, the Sarfati article does not disclose a multi-foil optic comprising a plurality of flat plates positioned normal to an arc as recited in claims 1, 6 and 9. Rather, the Sarfati article discloses at page 2 that the device comprises a 5 cm by 5 cm array of tiny square hollow tubes (10-200 microns across) made of X-ray-reflecting lead glass, about 0.5-1.0 mm deep, which is heated and curved into part of the sphere, like a lobster eye. A hundred such devices are grouped into modules, and 20 such modules are fitted to a telescope. As such, it is apparent that the Sarfati article discloses a device constructed of multiple channels, not a device constructed of multiple plates, as recited in claims 1, 6 and 9.

In addition, structural differences between the Sarfati device and the multi-foil optics recited in claims 1, 6 and 9 are significant from a manufacturing perspective.

As noted at page 2 of Sarfati article, an "elaborate process" is required to produce the device disclosed therein. Presumably, the "elaborate process" is a microchannel plate (MCP) fabrication process, such as disclosed in the Peele article at pages 4 and 5, considering the reference at page 2 of the Sarfati article to "lead glass", which is known to be used in fabrication of MCPs. In contrast, multi-foil optic devices as recited in claims 1, 6, and 9 can be manufactured with relative ease using precision positioning equipment, such as noted at paragraph 21 of the present application. Accordingly, structural differences between the Sarfati device and the multi-foil optics recited in claims 1, 6 and 9 are significant from a manufacturing perspective.

For at least the above-noted reasons, withdrawal of the rejection and allowance of claims 1, 6 and 9 are respectfully requested. Claims 2-5, 7, 8, 10 and 11 are allowable at least by virtue of dependency.

Also, with regard to claim 3, the Office suggests that the combination of the above-noted references allegedly teaches the use of ultraviolet (UV) lithography to manufacture computer chips using the Sarfati device, but not the use of extreme ultraviolet (EUV) lithography. The Office then alleges that the use of EUV lithography is notoriously well known. Applicants traverse the Office's comments in this regard and respectfully point out that the Sarfati article at page 2 actually discloses that UV lithography has created features 0.18 micron in size and that using a lobster-eye device as disclosed therein in reverse to produce a parallel beam of X-rays could be useful in creating smaller features. Thus, it is believed that the Office's characterization of the applied references as applied to claim 3 is mistaken.

The Office Action also includes a rejection of claims 4 and 5 under 35 U.S.C. § 103(a) as allegedly being unpatentable over the Sarfati article, the Petre article,

and the Zola patent as applied to claim 1, and further in view of the McDonald publication (U.S. Patent Application Publication No. 2002.0021782). This rejection is respectfully traversed.

Claims 4 and 5 depend from claim 1, and these claims are therefore allowable at least by virtue of dependency. Moreover, contrary to the Office's suggestion, the device illustrated in Figure 6 of the McDonald publication is does not provide total reflection. Rather, paragraph 23 states that reflection in that device is not ideal and that there are absorption losses. Moreover, the McDonald device is a polycapillary device, not a device comprising a plurality of plates as recited in the present claims. For at least these reasons, withdrawal of the rejection and allowance of claims 4 and 5 are respectfully requested.

As a further comment, the art cited in paragraph 4 of the Office has been reviewed, and it is believed that the Office's assessment of those references is mistaken. It is believed that the present claims are patentable over those references taken singly or in combination.

New Claims 12-20

New claims 12-20 have been added herein. Support for these claims may be found at least at paragraphs 19 and 25. The claims are allowable at least by virtue of dependency from their respective independent claims (claims 1, 6, and 9). In addition, it is respectfully submitted that the subject matter recited in claims 12-20 is not disclosed in either the Sarfati article, the Petre article or the Zola patent. Claims 12-20 are further allowable for at least this additional reason.

Conclusion

In light of the above, withdrawal of the objection and rejections of record, and allowance of the present application, are respectfully requested. Should any questions remain, the Office is invited to contact the undersigned at the number below.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

Date: October 25, 2004

By: 
Douglas H. Pearson
Douglas H. Pearson
Registration No. 47,851

P.O. Box 1404
Alexandria, Virginia 22313-1404
(703) 836-6620